

FIG. 1

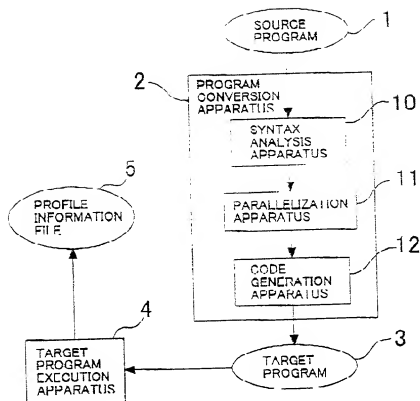


FIG. 2

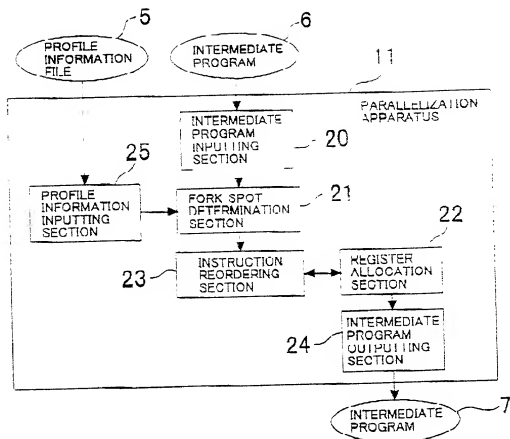


FIG. 3

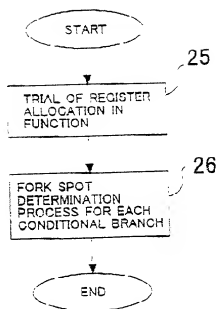


FIG. 4

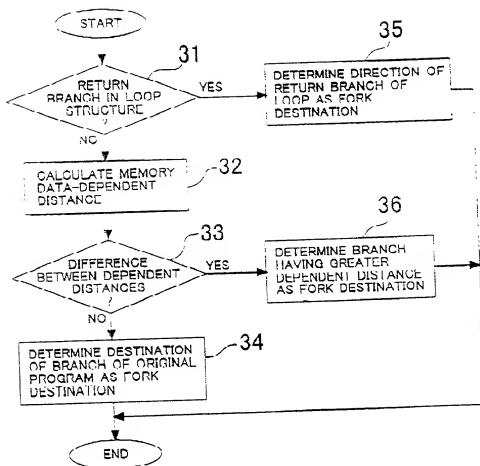


FIG. 5

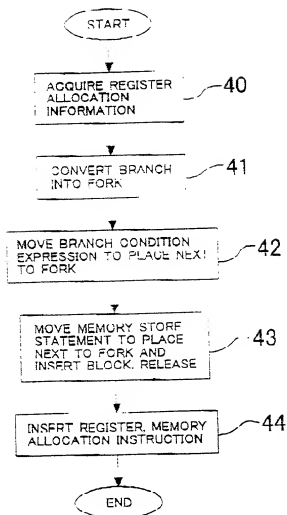


FIG. 6(A)

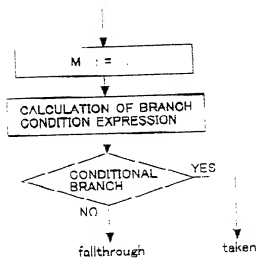


FIG. 6(B)

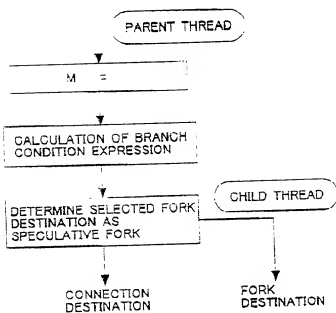


FIG. 6(C)

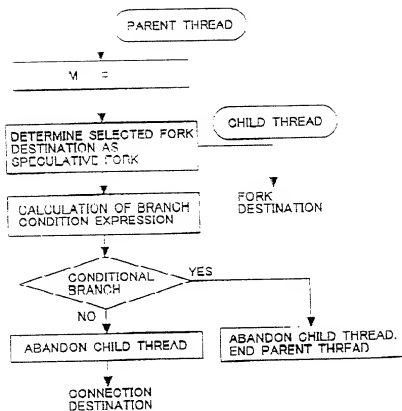




FIG. 6(D)

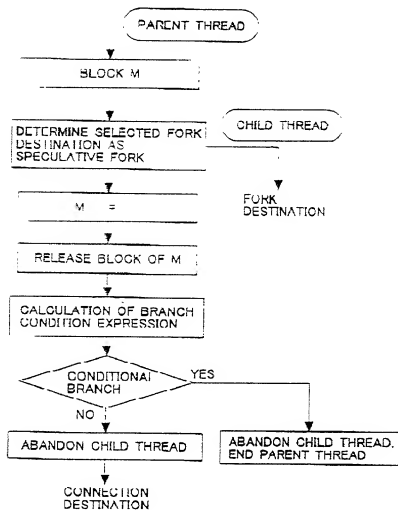
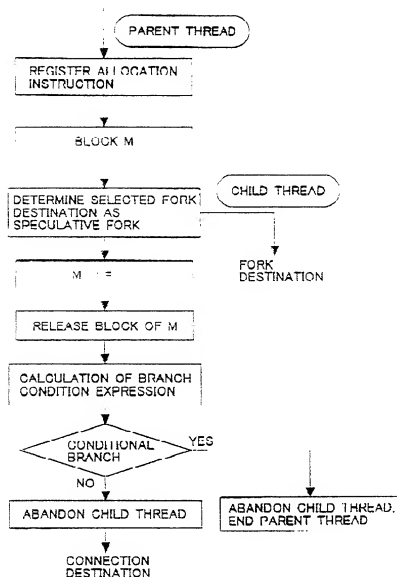


FIG. 6(E)



# FIG. 7

SPFORK 1	TO CREATE A SPECULATION MODE CHILD THREAD FOR STARTING EXECUTION FROM 1
TTERM c	TO END SELF THREAD AND SETTLE CHILD THREAD IF C IS TRUE
FTERM c	TO END SELF THREAD AND SETTLE CHILD THREAD IF C IS FALSE
THABORT	TO ABANDON A CHILD THREAD OF A SPECULATION MODE
BLACK m	TO DESIGNATE A MEMORY ADDRESS DESIGNATED WITH M AS BLOCK
RELEASE m	TO CLEAR BLOCK SET TO MEMORY ADDRESS DESIGNATED WITH M
DSPIN	TO CREATE A CHILD THREAD CREATED BY SUCCEEDING FORK IN DATA-DEPENDENT SPECULATION MODE
DSPOUT	TO CLEAR DATA-DEPENDENT SPECULATION MODE OF CHILD THREAD
RDCI t...	TO INSTRUCT TO ALLOCATE INTERMEDIATE TERMS/ VARIABLES DESIGNATED WITH t, ... TO REGISTER
MDCI t....	TO INSTRUCT TO ALLOCATE IMMEDIATE TERMS/ VARIABLES DESIGNATED WITH t, ... TO MEMORY

# FIG. 8

```

(1)  t1 := &X
(2)  t2 := 1
(3)  t3 := 4
(4)  t4 := t2 * t3
(5)  t5 := t1 + t4
(6)  t6 := 1
(7)  mem(t5) = t6
(8)  t7 := 1
(9)  t8 := 20
(10) t9 := t7 > t8
(11) if false then goto L2
(12) L1:
(13) t10 := &X
(14) t11 := 1
(15) t12 := 4
(16) t13 := t11 * t12
(17) t14 := t10 + t13
(18) t15 := mem(t14)
(19) t16 := 1
(20) t17 := t15 - t16
(21) R := t17
(22) goto L3
(23) L2:
(24) t18 := K
(25) t19 := 10
(26) t20 := t10 / t19
(27) R := t20
(28) t21 := &X
(29) t22 := 1
(30) t23 := 4
(31) t24 := t22 * t23
(32) t25 := t21 + t24
(33) t26 := mem(t25)
(34) t27 := R
(35) t28 := t26 + t27
(36) R := t28
(37) L3:

```

(B1)

(B2)

(D3)

FIG. 9

```

(51)  t1 := &X
(52)  t2 := 1
(53)  t3 := 4
(54)  t4 := t2 + t3
(55)  t5 := t1 + t4
(56)  t6 := 1
(57)  mem(t5) := t6
(58)  SPFORK L2
(59)  t7 := 1
(60)  t8 := 20
(61)  t9 := t7 > t8
(62)  FTERM
(63)  ABORT
(64)  goto L1
(65)  L1:
(66)  t10 := &X
(67)  t11 := J
(68)  t12 := 4
(69)  t13 := t11 * t12
(70)  t14 := t10 + t13
(71)  t15 := mem(t14)
(72)  t16 := J
(73)  t17 := t15 + t16
(74)  R := t17
(75)  goto L3
(76)  L2:
(77)  t18 := K
(78)  t19 := 10
(79)  t20 := t18 / t19
(80)  R := t20
(81)  t21 := &X
(82)  t22 := J
(83)  t23 := 4
(84)  t24 := t22 * t23
(85)  t25 := t21 + t24
(86)  t26 := mem(t25)
(87)  t27 := R
(88)  t28 := t26 + t27
(89)  R := t28
(90)  L3:

```

(B1)

(B2)

(B3)

```

(101) t1 := 3X
(102) t2 := I
(103)
(104) t4 := t2 + t3
(105) t5 := t1 + t4
(106) BLOCK t5
(107) SPORK L2
(108) t6 := I
(109) mem(t5) := t6
(110) RELEASE t5
(111) t7 := I
(112) t8 := 20
(113) t9 := t7 > t8
(114) FTERM
(115) THABORT
(116) goto L1
(117) L1:
(118) t10 := &X
(119) t11 := J
(120) t12 := 4
(121) t13 := t11 * t12
(122) t14 := t10 + t13
(123) t15 := mem(t14)
(124) t16 := J
(125) t17 := t15 + t16
(126) R := t17
(127) goto L3
(128) L2:
(129) t18 := K
(130) t19 := 10
(131) t20 := t18 / t19
(132) R := t20
(133) t21 := &X
(134) t22 := J
(135) t23 := 4
(136) t24 := t22 + t23
(137) t25 := t21 + t24
(138) t26 := mem(t25)
(139) t27 := R
(140) t28 := t26 + t27
(141) R := t28
(142) L3:

```

# FIG. 11

```

(201) RDCL t1 = t9
(202) RDCL t1
(203) MDCL X
(204) t1 = 8X
(205) t2 = 1
(206) t3 = 4
(207) t4 = t2 + t3
(208) t5 = t1 + t4
(209) BLOCK t5
(210) SPFORK L2
(211) t6 = 1
(212) mem(t5) = t6
(213) RELEASE t5
(214) t7 = 1
(215) t8 = 20
(216) t9 = -7 > t8
(217) FTERM
(218) THABORT
(219) goto L1
(220) L1:
(221) RDCL t10 = t17
(222) RDCL R
(223) MDCL X, J
(224) t10 = 2X
(225) t11 = J
(226) t12 = 4
(227) t13 = t11 * t12
(228) t14 = t10 + t13
(229) t15 = mem(t14)
(230) t16 = J
(231) t17 = t15 + t16
(232) R = t17
(233) goto L3
(234) L2:
(235) RDCL t18 = t28
(236) RDCL R
(237) MDCL X, J
(238) t18 = K
(239) t19 = 10
(240) t20 = t18 / t19
(241) R = t20
(242) t21 = 8X
(243) t22 = J
(244) t23 = 4
(245) t24 = t22 * t23
(246) t25 = t21 + t24
(247) t26 = mem(t25)
(248) t27 = R
(249) t28 = t26 + t27
(250) R = t28
(251) L3:

```

(B1)

(B2)

(R3)

# FIG. 12

```

(255) r21 := &X
(256) r22 := r11
(257) r23 := 4
(258) r24 := r22 * r23
(259) r25 := r21 + r24
(260) BLOCK r25
(261) SPFORK L2
(262) r26 := 1
(263) mem(r25) = r26
(264) RELEASE r25
(265) r27 := r11
(266) r28 := 20
(267) r29 := r27 / r28
(268) FTERM r29
(269) THABORT
(270) goto L1
(271) L1:
(272) r20 := &X
(273) r21 := mem(&J)
(274) r22 := 4
(275) r23 := r21 + r22
(276) r24 := r20 + r23
(277) r25 := mem(r24)
(278) r26 := mem(&J)
(279) r27 := r25 + r26
(280) r12 := r27
(281) goto L3
(282) L2:
(283) r20 := r13
(284) r21 := 10
(285) r22 := r20 / r21
(286) r12 := r22
(287) r23 := &X
(288) r24 := mem(&J)
(289) r25 := 4
(290) r26 := r24 * r25
(291) r27 := r23 + r26
(292) r28 := mem(r27)
(293) r29 := r12
(294) r30 := r28 + r29
(295) r12 := r30
(296) L3:

```



FIG. 13

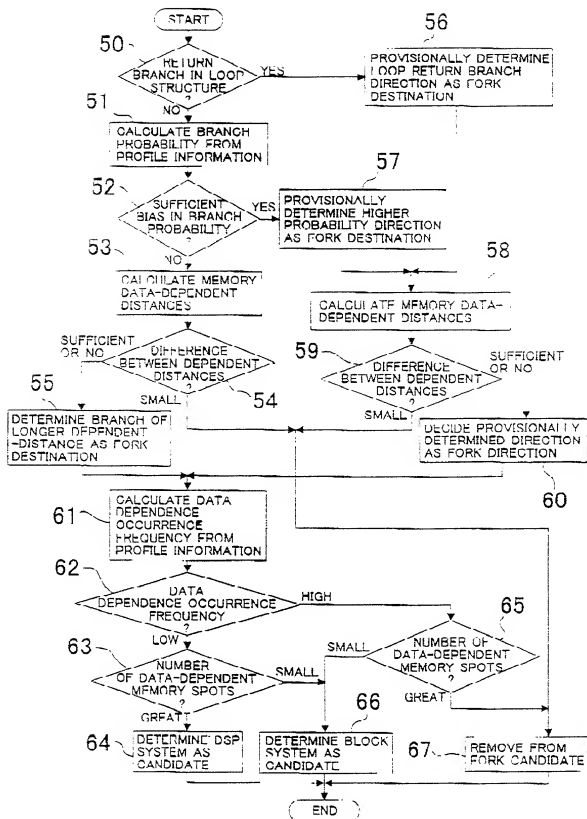


FIG. 14

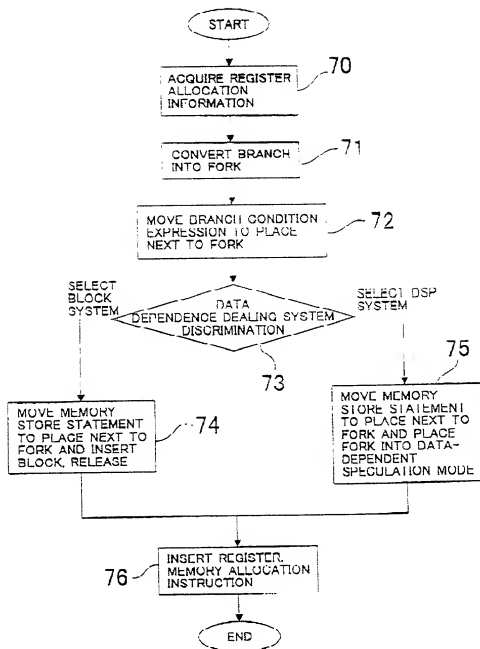


FIG. 15

```

t1 := P
t2 := 0
t3 := t1 < t2
if false goto L2
L1:
t4 := 0
p := +4
L2:
t5 := 0
t6 := 15
t7 := t5 > t6
if false goto L4
L3:
t8 := 0
o := t8
L4:
t9 := P
t10 := P
t11 := t9 << t10
j := t11
t12 := 2
mem(t12) := t11
t13 := 2X
t14 := 0
t15 := 4
t16 := t14 * t15
t17 := t13 + t16
t18 := mem(t17)
t19 := j
t20 := t18 + t19
mem(t17) := t20
K := t20
t21 := 2X
t22 := P
t23 := 4
t24 := t22 * t23
t25 := t21 + t24
t26 := mem(t25)
t27 := 9
t28 := t26 > t27
if false goto L6
L5:
t29 := 2X
t30 := P
t31 := 4
t32 := t30 * t31
t33 := t29 + t32
t34 := mem(t33)
t35 := 1
t36 := t34 + t35
mem(t33) := t36
L6:
t37 := 2Y
t38 := P
t39 := 4
t40 := t38 * t39
t41 := t37 + t40
t42 := mem(t41)
t43 := K
t44 := t42 + t43
j := t44

```

(R11)

(B12)

(R13)

(B14)

(B15)

(B16)

(B17)

# FIG. 16(A)

## BRANCHING NUMBER

R 11	R 12: 2D	R 13: 18D
R 13	R 14: 3D	R 15: 17D
B 15	B 16: 3D	B 17: 17D

# FIG. 16(B)

## MEMORY DATA DEPENDENCE

B 15 → B 16	12D
B 15 → R 17	4

FIG. 17

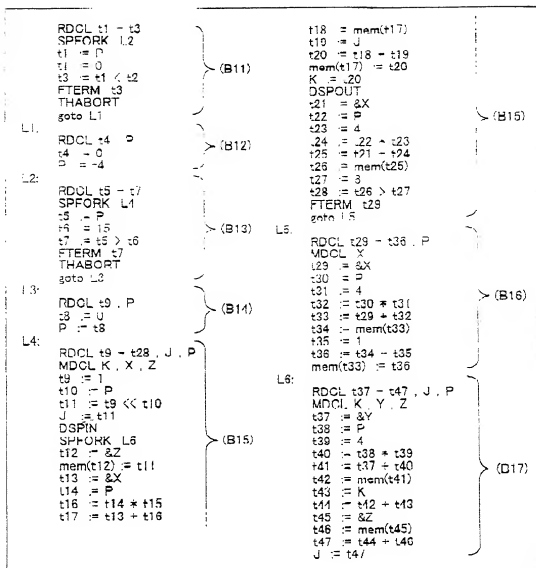




FIG. 19

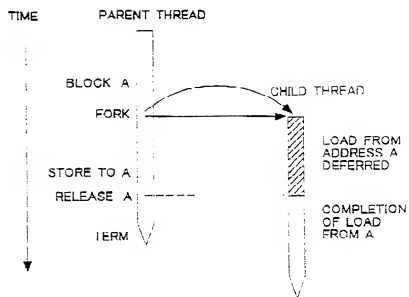


FIG. 20(A)

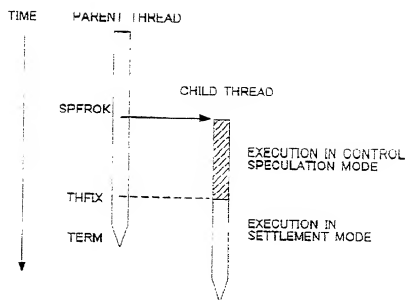
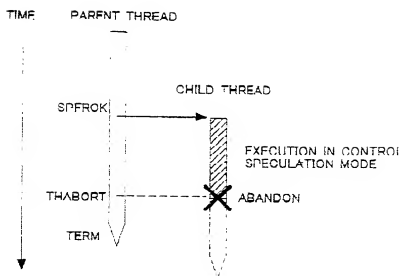




FIG. 20(B)



# FIG. 21

